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Application of Diagnostic and Educational Tools to Control Childhood Parasitic Infections in the School Environment

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Methods: This work is a cross-sectional coproparasitological study, addressing quantitative and qualitative aspects of children aged 12 years or less, who were enrolled in public schools or daycare centers selected for this work and presented the Informed Consent Form (ICF) signed by parents or guardians. The collected samples were submitted to the techniques of Hofmann and modified Kinyoun.

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Application of Diagnostic and Educational Tools to Control Childhood Parasitic Infections in the School Environment

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Methods: **This work is a cross-sectional coproparasitological study, addressing quantitative and qualitative aspects of children aged 12 years or less, who were enrolled in public schools or daycare centers selected for this work and presented the Informed Consent Form (ICF) signed by parents or guardians. The collected samples were submitted to the techniques of Hofmann and modified Kinyoun. Also, lectures were realized for parents, guardians, and employees of Schools or Nurseries and recreational actions for children.**

Results: **A total of 705 samples were collected, of which 340 were positive for 12 different parasite species. *Giardia lamblia* (24.9%), *Cryptosporidium* spp (23.6%), and *Endolimax nana* (21.4%) were the most recurrent among schoolchildren between 2010 and 2018. About applied educational playful practices, they proved to be effective in building knowledge and raising awareness about parasitic endemics, evidencing the need for more practices like these in schools and communities in general.**

Conclusion: **This work presented an expanded view of the parasites' permanence in the school environment and the importance of educational practices aimed at transforming life habits that are harmful to health.**

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I. Introduction

Intestinal parasite infections produced by protozoan and helminths still constitute one of the main global causes of infant morbidity and mortality (1). The prevalence of such infections affects several countries and territories in the world because despite being cosmopolitan, the transmission of parasites is dependent on the conditions of the host, parasite, and environment (2).

Currently, around 3.5 million people worldwide are affected by one or more species of parasites, representing a relevant public health problem (3). In an analysis of the incidence of intestinal parasite infections of different age groups in children, between 5 and 12 years old, were identified as one of the most affected groups (4). Children are also more likely to generate symptoms and clinical manifestations of parasite infections (cognitive impairment, decreased growth, irritability, and susceptible increase in other pathogen infections), reducing their quality of life (3,5).

One of the biggest causes of children's susceptibility to parasites is due to their immature immune system combined with the precariousness of maintaining personal hygiene (6). Frequent contact with soil and water during recreational activities without guidance can determine the transmission and prevalence of enteroparasitosis in homes and schools (7,8).

In Brazil, the prevalence of parasitic diseases in schoolchildren is directly associated with a low Human Development Index (HDI), ranging from 2% to 36%, reaching 70% in more alarming cases (9). The North and Northeast regions of the country have high prevalence and polyparasitism in several communities, with a high diversity of species involved (10,11). Among the intestinal parasitoses that affect children, the most frequent are those whose means of transmission is the oral-fecal route. Since they are associated with the ingestion of contaminated water or food, as is the case of *Ascaris lumbricoides*, *Entamoeba histolytica*, *Enterobius vermicularis*, *Trichuris trichiura*, and *Giardia lamblia* (12,13).

Prevention is still the best way to avoid enteroparasitosis. In this sense, health education practices in schools and communities improve the knowledge of the population about the risk factors that lead the individual to be infected (14). Because although many individuals assure knowledge about intestinal parasitic diseases, studies reveal that, they have

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misunderstandings regarding the preventive and curative measures of worms (9).

Lack of knowledge about preventive measures, the basic principles of personal hygiene, and care in food handling can contribute to the spread of the disease, facilitate infections and precipitate reinfection in areas considered endemic (15,16,17). Thus, it is necessary to include parents/guardians, teachers, and students in educational activities to make them trained in educational actions (9). The partnership of family and school minimizes the difficulties encountered in the school environment, adding knowledge about the realities experienced (19,20).

This study aimed to evaluate the frequency of intestinal parasites observed in school-age children in the city of Recife, Pernambuco and to determine their main species and intervene in the school environment through playful educational practices to make students, parents, and employees aware of the preventive measures that were took to avoid the contamination of these parasites.

Thus, the present work aimed to identify intestinal parasites, as well as evaluate your frequency in school-age children in the city of Recife, Pernambuco. And intervene in the school environment through educational practices to make students, parents, and employees aware of the preventive measures to avoid the contamination of these parasites.

II. Material and Methods

a) Study population

A total of 705 fecal samples did collect from children aged 12 years or less from different public schools or daycare centers located in the city of Recife, PE, between the years 2008 and 2018.

The followed inclusion criteria did consider were the age of the children (aged 12 years or less), public schools and the Informed Consent Form (ICFs) accepted by the parents/guardians.

Regarding the exclusion criteria, children over the age of 12 did not participate in the analysis; private schools and daycare and the absence of parents/guardians that do not agree with their children's participation.

b) Ethical aspects

The study was approved by the Ethics Committee of the Health Sciences Center (CCS) of the Federal University of Pernambuco (UFPE), presenting the CAAE number: 19640213.0.1001.5208. All children enrolled in this study had the ICF signed by their parents/guardians.

c) Sample collection

All children or their participating guardians received the ICF and the plastic collecting jars, without preservatives, and received instructions about how to collect the fecal sample correctly. Two days after, we received the signed ICF and identified collecting pots. All fecal samples were processed and analyzed by expertise personal at the Parasitology Laboratory of the Medical Sciences Center (LP/CCM) by the Federal University of Pernambuco (UFPE).

d) Analysis and processing of parasitological samples

In the laboratory, fecal material was stored under refrigeration between 4 °C and 8 °C until analysis. First, a macroscopic evaluation of the fecal material was carried out to observe the presence of larvae or helminth proglottids. Samples were processed by the Hoffman/Lutz methods (spontaneous sedimentation) for protozoan cysts, helminth eggs or larvae detections (21) and the modified Kinyoun technique using fuchsin-carbolic, to search for *Cryptosporidium* spp. (22). For each stool collector, two slides were arranged per technique. Enteroparasites were identified by optical microscope under 10 X, 40 X, and/or 100 X objectives. All results were confirmed by a supervisor.

e) Health education

Awareness about health education was carried out after each stool collection cycle, in schools or daycare centers that are suitable for research, in the year of the study. Through educational activities previously planned by undergraduate students in the health field, together with teachers associated with the LP/CCM/UFPE, parents, guardians, and employees of the Schools were directed to lectures of the type expository-dialog. To bring basic knowledge about parasites, how to identify and the prevention and treatment measures to be taken.

While for children, theatrical plays, competitive and musical games were carried out, to bring knowledge and information playfully about the risks of parasitic infections. Discussing aspects such as signs and symptoms of the disease, modes of transmission, biological cycle of the parasites and reinforcement of prophylaxis measures, both individual and collective. About educational practices aimed at enteroparasitosis, undergraduate students in the health area were mobilized, along with professors from UFPE. Each year, a different school received an interactive lecture with parents or guardians and school staff.

The results of the exams were made available simply and lucidly to the students' guardians. Positive cases of parasite infection were send to treatment at a local Health Center. The education practices about health were carried out after each stool collection cycle in schools or daycare centers that are suitable for this research. First, realized with the parents, guardians, and employees of the Schools. The method employed was an expository-dialog about fundamental knowledge parasites and how to identify them as well as the prevention and treatment.

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f) Data analysis

This study comprehends qualitative and quantitative methods (23). A descriptive analysis was performed, using data obtained from coproparasitological exams. Based on the reports, a spreadsheet survey was performed in Office Excel 365, addressing the number of participating children, the number of samples of fecal material collected, and their respective positivity or negativity.

III. Results

Between the period of 2008 to 2018, 730 coproparasitological exams were performed on children under 12 years old. These total, 421 samples were negatives, representing 57.67%, and 309 were positive for one or more enteroparasites, with a percentage rate of 42.33%.

Figure 1 shows the relatives frequencies of positivity, over the ten years of parasitological analysis of the Daycare and Schools studied. Higher numbers of positive diagnoses for enteroparasitosis were observed in the years 2013 and 2016, with percentage rates of 84.61% (22/26) and 69.38% (68/98), respectively. However, the lowest number of positive parasite reports were observed in 2014 and 2017, with 15.38% (10/65) and 21.91% (16/73), respectively.

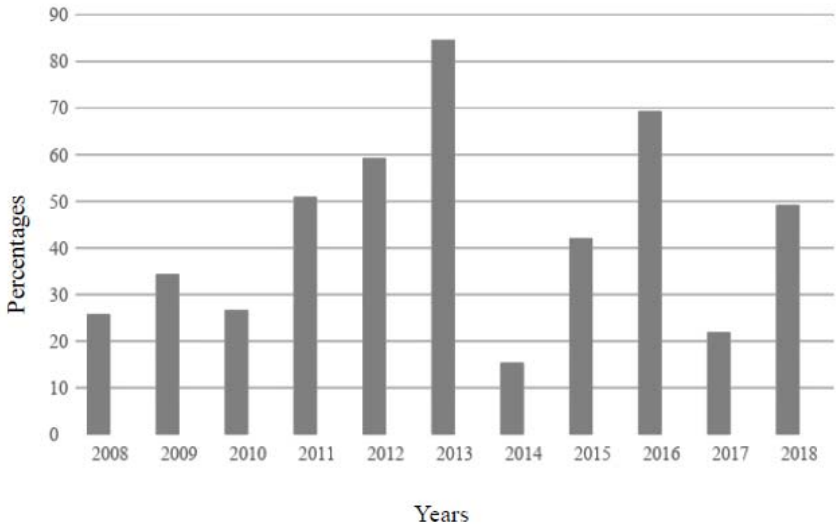

Figure 1: Relative frequency of positive samples for enteroparasites, from 2008 to 2018, in schoolchildren under 12 years old, in the city of Recife-PE.

Regarding the main species of parasites found in microscopic evaluations, were identified 12 different species of protozoa and helminths between 2008 and 2018 (Table 1). Related to all identified enteroparasitoses, a higher positivity rate of protozoa, like as *Giardia lamblia* (26.4%), *Endolimax nana* (24.7%), *Cryptosporidium* spp (17.5%) and *Entamoeba coli* (9.9%) when compared to helminths: *Ascaris lumbricoides* (8.2%), *Ascilostoma* spp (2.1%) and *Trichuris trichiura* (0.5%).

In accordance to Table 1, the highest frequency of *Cryptosporidium* spp (75.5%), *G. lamblia* (54.8%), and *E. nana* (40%) occurred in the years 2015, 2017, and 2014, respectively. Whereas no parasite of the species *Blastocystis hominis, Ancilostoma* sp, *Iodameba butschlii*, *Balantidium coli,* and *Taenia* sp were detected in the same years.

Among the analyzed years, the largest absolute frequency of positive cases was seen in 2016, highlighting the species *Cryptosporidium* spp 39/68 (57.35%), *Endolimax nana* 11/68 (16.17%), and *Ascaris lumbricoides* 10/68 (14.7%). In the second-highest frequency of enteroparasites, the year 2012 also showed high positivity for *Endolimax nana* 12/48 (25%). Despite the high case number showed in the same year, the relative frequency was no higher due to the total number of samples.

However, unlike in 2016, the species *Giardia lamblia* and *Entamoeba histolytica/E. dispar* were the most present species in the stool samples collected in

2012, being responsible for 22.9% and 18.5% of infections.

Another year with a high absolute frequency of parasites was 2015 (N=37). The parasite specie *Cryptosporidium* spp reached 28/37 (75.5%) of students parasitizeds. While others parasites identified were *E. nana* 9/37 (24.3%), *G. lamblia* 5/37 (13.5%), *E. histolytica/E. dispar* 3/37 (8%), *A. lumbricoides* 3/37 (8%), and *E. coli* 1/37 (2.7%).

Specifically in 2014 occurred the lowest number of parasite positivity (N=10), with *E. nana* 4/10 (40%), *Giardia lamblia* 2/10 (20%) and *Ascaris lumbricoides* 2/10 (20%). Others years, like 2009, 2010 and 2017 presented also a low number of positive samples, showed positivity to *G. lamblia*, varying between 45.5%, 31.3%, and 54.6%, *E. coli* 18.2%, 18.5% and 12.5%, respectively.

In regards to the educational practices, the employees and parents/guardians of the Schools were given lectures focused on parasitic endemics, the signs, and symptoms of enteroparasitosis; how to identify when children are under such infections, and how to prevent their biological cycle (Figure 2A and B). In this practice, limited knowledge on the subject was noted, both by those responsible for the children and school staff. However, throughout the lectures, a great familiarity with the theme was seen when the public stated that friends, relatives, or the parents/guardians themselves had such symptoms or were diagnosed.

Figure 2: A and B: Educational practices for employees and parents/guardians of the Schools.

Children's guardians, however, expressed doubts about some home treatments, passed down through generations. In one of the reports, it was reported that sitting in a basin containing warm water eliminates *Strangyloides stercoralis* and reduces the itching caused by the parasite. Thus, employees intervened in the knowledge of practices like these, demystifying and reporting the best way to follow palliative and curative practices.

About the children, playfully, theaters, competitive games, musicals, and/or more interactive conversations about parasites were made to attract attention and build knowledge. As a result, great mobilization and interaction were seen, showing interest in the subject and confirming the knowledge received during questioning (Figure 3A and B). When reported on popular names of enteroparasitoses and hygiene habits, a certain prior understanding was evidenced. However, many said they were not adept at such habits that protect from parasitic diseases.

Figure 3A and B: Application of playing educational actions concerning parasitic endemics.

IV. Discussion

This work is the first in the State of Pernambuco to use educative strategies to combat enteroparasitosis in public school and daycare through the fecal parasitological examination of the schoolchildren and adoption of health educative measures to aim children and their parents to combat parasite infections. An expanded view of the permanence of parasites in the school environment and the importance of educative practices were able to transform life habits.

All the evaluated daycare and schools showed children with parasite contamination. In this study, between the years 2008 and 2018, were observed high frequencies of commensal protozoa, *Endolimax. nana*, and agents capable of generating human morbidity, as is the case of *Giardia lamblia* and *Cryptosporidium* spp. These three parasites are frequently found in Brazilian children's coproparasitological exams (24-26).

The high frequency of *E. nana* in schoolchildren can be an indicator of hygiene lacking, as demonstrated in the study conducted in Caxias do Sul, with *E. nana* cysts identified in 60% of the analyzed samples (27). Another study in Paracatu (MG) also associates the lack of hygienic care with the occurrence of commensal parasites in nine public schools, with a prevalence of 16.5% for *E. nana* (28). In João Pessoa, Paraíba, a study in children also suggested the same justification for the prevalence of *E. nana* in 40.9% of fecal samples from children (29).

The infection by *E. nana* does not give major symptomatological effects, but promote a greater susceptibility to other parasite infections (30). The major problem of polyparasitism is the clinical manifestations caused for combination by commensal parasites and pathogenic (31). However, it's common a high incidence of polyparasitism like as seen in the study carried out by (32) showed *E. nana* associated in 36.3% of the cases with *Entamoeba coli*, and 9.2% with the species *Ascaris lumbricoides* and *Iodamoeba butschlii*. Similar results were seen in public daycare and preschools from São Sebastião da Grama, São Paulo State, the *E. nana* and *Blastocystis* spp were combined with the species *G. duodenalis*, *E. coli*, *Entamoeba. histolytic/dispar*, *Strongyloides. stercoralis*, *Taenia* sp., and *I. Butschlii* (33).

The present study also showed a high number of sample positives for *G. lamblia*, an important parasite species responsible for giardiasis that presents diarrhea, abdominal pain, nausea, vomiting, flatulence, anorexia, and fever as symptoms (34). In many cases, diarrheal disease is short-lived and self-limiting. However, some individuals have persistent diarrhea with malabsorption of nutrients, interfering with the quality of life (35).

Similar to our results there are other studies showed enteroparasites contamination of children inside daycare and school environments (36,37). *Giardia lamblia* was the most common species found in many of these Brazilian studies. In Ribeirão Preto, São Paulo, 50.8% of children infected with parasites obtained positive results for *G. lamblia* (36). In a public school in Cariaca, Espirito Santo revealed a 23% positivity for *G. lamblia* (37). In a philanthropic institution, the habits of hygiene and contact with soil were suggested as one of the causes of the prevalence of *Giardia* spp. (31%), as well as *Cryptosporidium* spp. (62.5%) (38).

For a long time, it believes that cryptosporidiosis affects only immunodeficient individuals. But in recent years, was detected *Cryptosporidium* spp. in immunocompetent people that exhibit watery diarrhea, vomiting, nausea, loss of appetite, weight loss, fatigue, and other symptoms (39). Children under eight years of age were the most affected (38). Despite this, in Brazil, the detection of *Cryptosporidium* spp. and other coccids are not included in routine parasitological examinations, being only investigated with a medical request (40). Thus, the presence of *Cryptosporidium* spp in schools and daycare centers is not properly investigated in the country.

The incidence of infectious and parasitic diseases in preschool children have a relationship with efficient sanitation (41). Also, the lack or low adherence of parents or guardians can underreport the presence of parasites and interfere with the development of parasitological work in schoolchildren (42). This difficulty in adhering to parasitological research is reported by Reuter and collaborators (2015), who received a low number of samples from a daycare center in the Rio Grande do Sul (43). Vargas and Amaral (2016) associate the absence of parental attention to this type of research with the rush of everyday life, which makes it difficult to interact with educational activities (42).

In the present study, the years most affected by low interaction between parents/guardians were 2014 and 2017, with lower absolute and relative frequencies due to the number of stools received. However, these years dispelled parasites such as *G. lamblia*, *E. nana*, *E. histolytica/disparate*, *E. coli*, and *Ascaris lumbricoides*, agents capable of generating morbidity to those infected and being disseminated among children in the school environment (44).

Some strategies to reduce the parasite contamination of schoolchildren can be useful to educate and stimulate the children to repass information about the prevention of parasite diseases to their families and friends. Recreational activities, theatre, musical, and games are educative tolls to transmit knowledge about health and hygiene (14,45). Though these tools like theater, musicals, and games duly adapted to the reality of that parasite affect the children can influence their creativity, motor activity, provide relaxation, and develop socio-cultural abilities, providing

more dynamic and active learning. The construction of children's knowledge about parasites has a positive impact on the change in hygiene behavior, as well as reflected in the rates of geohelmintic infections and other parasites in homes and schools (46).

Educative activities aimed at raising awareness and preventing intestinal parasites are efficient alternatives to fill the process, the gaps found in the content covered in schools (9). Thus, it is essential to plan health education actions to reduce the high rates of morbidity and mortality; and increase health information in the search for the best health status and quality of life (47).

The combination of theory with practice is complementary because the previous knowledge students there are better consolidation of learning during moments of experience (48). Thus, the role of educators and health professionals is to provide knowledge and encourage both parents and students to acquire healthy habits. These actions become essential for the prevention of intestinal parasites (49).

Punctual educative practice will not change the actual situation of high parasite contamination of schoolchildren. However, these actions must be continuous with the insertion and collaboration of parents, which are essential for the change of their children's behavior. Different studies claim that collaboration between the family and the school is important to reduce the difficulties encountered in the school environment since knowledge is constantly experienced (19,20).

Throughout these 10 years of study, the coproparasitological analysis in schoolchildren showed the need for greater attention to enteroparasitosis inside school and daycare environments, since there was parasite positivity in all children evaluated. Thus, some educative actions applied in this study were crucial for building knowledge in the children about forms to detect and prevent parasite contaminations, change bad hygiene and health habits and disseminate learning to other children, their teachers, and members of the family.

References Références Referencias

1. Basualdo JA, Córdoba MA, Luca MMD, Ciarmela ML, Pezzani BC, Grenovero MS, et al. Intestinal parasitoses and environmental factors in a rural population of Argentina, 2002-2003. Revista do Instituto de Medicina Tropical de São Paulo. 2007; 49(4): 251-255.
2. Frei F, Juncansen C, Ribeiro-Paes JT. Epidemiological survey of intestinal parasite infections: analytical bias due to prophylactic treatment. Cadernos de saude publica. 2008; 24(12): 2919-2925.
3. World Health Organization. Integrating neglected tropical diseases into global health and development: fourth WHO report on neglected tropical diseases. Geneva: World Health Organization; 2017.
4. World Health Organization. *Investing to overcome the global impact of neglected tropical diseases: third WHO report on neglected tropical diseases 2015*. Geneva: World Health Organization; 2015.
5. Belo VS, Oliveira RBD, Fernandes PC, Nascimento BWL, Fernandes FV, Castro CLF, et al. Fatores associados à ocorrência de parasitoses intestinais em uma população de crianças e adolescentes. Revista Paulista de Pediatria. 2012; 30(2): 195-201.
6. Zanotto M, Cavagnolli NI, Breda JC, Dalla Santa Spada PKW, Bortolini GV, et al. Prevalence of intestinal parasites and socioeconomic evaluation of a country town in the Serra Gaucha region, Rio Grande do Sul, Brazil. Revista de Patologia Tropical/Journal of Tropical Pathology. 2018; *47*(1), 19-30.
7. Frei F, Juncansen C, Ribeiro-Paes JT. Levantamento epidemiológico das parasitoses intestinais : viés analítico decorrente do tratamento profi lático Epidemiological survey of intestinal parasite infections : analytical bias due to prophylactic treatment. Cadernos de Saúde Pública. 2008; 24(12): 2919–25.
8. Filho HBA, Carmo-Rodrigues MS, Mello CS, Melli LCFL, Tahan S, Mauro Batista de Morais. Parasitoses intestinais se associam a menores índices de peso e estatura em escolares de baixo estrato socioeconômico. Revista Paulista de Pediatria. 2011; 29(4): 521–8.
9. Bragagnollo GR, Godoy2 PCG de T, Santos TS dos, Ribeiro V dos S, Morero JAP, Ferreira BR. Intervenção educacional sobre enteroparasitoses: um estudo quase experimenta. Revista Cuidarte. 2018; 9(1).
10. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Coordenação Geral de Desenvolvimento de Epidemiologia em Serviços. Guia de Vigilância em Saúde [Internet]. 1st ed. Serviços. . Ministério da Saúde. Secretaria de Vigilância em Saúde. Coordenação-Geral de Desenvolvimento da Epidemiologia em, editor. Ministério da Saúde. Brasilia; 2016 [cited 2020 Aug 5]. p. 773. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/guia_vigilancia_saude_1ed_atual.pdf
11. Pernambuco SE da S de. Plano Integrado de Ações para o Enfretamento às Doenças Negligenciadas no Estado de Pernambuco/ SANAR [Internet]. 2nd ed. Secretaria Estadual de Saúde. Secretaria Executiva de Vigilância em Saúde., editor. Vol. 5. Recife: Secretaria Estadual de Saúde. Secretaria Executiva de Vigilância em Saúde.; 2018. 115 p. Available from: http://portal.saude.pe.gov.br/sites/

portal.saude.pe.gov.br/files/plano_sanar_2_edicao_29.08.17.pdf.
12. Escobar-pardo ML, Paula A, Godoy O De, Machado RS, Rodrigues D, Neto UF, et al. Prevalence of intestinal parasitoses in children at the Xingu Indian Reservation. Jornal de Pediatria (Rio J). 2010; 86(6): 493–6.
13. Camila PC, Silva MC. Fatores de risco das endoparasitoses de escolares públicos da Bahia. Revista Saúde.Com. 2014; 10(3): 245–53.
14. Teixeira PA, Fantinatti M, Gonçalves MP, Silva JS da. Parasitoses intestinais e saneamento básico no Brasil: estudo de revisão integrativa. Brazilian Journal of Development. 2020; 6(5): 22867–90.
15. Andrade EC De, Cristina I, Leite G, Rodrigues VDO, Cesca MG. Parasitoses intestinais: uma revisão sobre seus aspectos sociais, epidemiológicos, clínicos e terapêuticos. Revista de APS. 2010; 13(2): 231–40.
16. Barra M, Bustos L, Ossa X. Desigualdad en la prevalencia de parasitosis intestinal en escolares de una escuela urbana y dos rurales de la comuna de Puerto Montt. Revista Medica de Chile. 2016; 144: 886–93.
17. UNA-SUS UA do S, UFMA UF do M. Saúde da criança e a saúde da família: Agravos e Doenças Prevalentes na Infância. Maia EC, Pessoa FS, Soares WL, editors. Universidade Federal do Maranhão. São Luís: Universidade Federal do Maranhão; 2014. 59 p.
18. da Costa Silva AB, Vieira IRS, Firmo WDCA, & dos Santos Aliança AS.Conhecimento acerca da prevenção e ocorrência de parasitoses intestinais em alunos do ensino médio de uma escola estadual do município de Maranhãozinho-MA. Research, Society and Development. 2020; *9*(7):e190974051-e190974051.
19. Silva SR da, Heller L, Valadares J de C, Cairncross S. O cuidado domiciliar com a água de consumo humano e suas implicações na saúde: percepções de moradores em Vitória (ES). Eng Sanit Ambient. 2009; 14(4): 521–32.
20. Freitas ADG de, Leite NRP. Linguagem fílmica: uma metáfora de comunicação para a análise dos discursos nas organizações. Rev Adm [Internet]. 2015; 50(1): 89–104. Available from: http://dx.doi.org/10.5700/rausp1186.
21. Neves DP, Wagner R, Vitor DA. Parasitologia Humana. 11th ed. Atheneu; 2010. 494 páginas.
22. González-Ruiz A, Bendall RP. The Use of the Ocular Micrometer in Diagnostic Parasitology Size Matters: Parositology Today. 1995;11(2):83–5.
23. Pereira AS, Shitsuka DM, Parreira FJ, Shitsuka R. Metodologia da pesquisa científica.[e-book]. Santa Maria. Ed (pp. 3-9). UAB/NTE/UFSM.2018. Disponível em: https://repositorio.ufsm.br/bitstream/handle/1/15824/Lic_Computacao_Metodologia-Pesquisa-Cientifica. Pdf.
24. David ÉB, Guimarães S, de Oliveira AP, de Oliveira-Sequeira TCG, Bittencourt GN, Nardi ARM, et al. Molecular characterization of intestinal protozoa in two poor communities in the State of São Paulo, Brazil. Parasites & vectors. 2015;8(1): 1–12.
25. Faria CP, Zanini GM, Dias GS, da Silva S, de Freitas MB, Almendra R, et al. Geospatial distribution of intestinal parasitic infections in Rio de Janeiro (Brazil) and its association with social determinants. PLoS Neglected Tropical Diseases. 2017; 11(3): e0005445.
26. Mariano A, Santos EN, Santos T, Mota TN, Silva J, Carvalho S, et al. Parasites in south Bahia: focus on giardiasis and ascariasis among preschoolers of Itabuna. International Journal of Health Sciences. 2015; 3(1): 61–75.
27. Camello JT, Cavagnolli NI, Dalla Santa Spada PK, Poeta J, Rodrigues AD. Prevalência de parasitoses intestinais e condições de saneamento básico das moradias em escolares da zona urbana de Caxias do Sul, Rio Grande do Sul. Scientia Medica. 2016; 26(1): ID21716–ID21716.
28. MG SOP. Prevalência de parasitos e comensais intestinais em crianças de escolas da rede pública municipal de Paracatu (MG). As realizações e os projetos de uma gestão participativa. 2005; 37(4): 209–13.
29. da Silva Monteiro AC, de Araújo Soares D, de Oliveira Ramalho SCP, Cavalcante UMB, Silva AB, de Toledo Vianna RP, et al. Intestinal parasitism and related risk factors for primary school students in João Pessoa, northeast Brazil. Bioscience Journal. 2018; 34(4).
30. Poulsen CS, Stensvold CR. Endolimax nana. In: Principles and Practice of Pediatric Infectious Diseases. Elsevier; 2018. p. 1309–10.
31. Graczyk TK, Shiff CK, Tamang L, Munsaka F, Beitin AM, Moss WJ. The association of Blastocystis hominis and Endolimax nana with diarrheal stools in Zambian school-age children. Parasitology research. 2005; 98(1): 38–43.
32. da Silva Pereira FR, Pedrotti LA, Zancanaro V. Incidência de parasitoses intestinais em uma escola municipal de educação básica situada no bairro Martello no município de Caçador/SC. Revista Interdisciplinar de Estudos em Saúde. 2016;96–105.
33. Rebolla MF, Silva EM, Gomes JF, Falcao AX, Rebolla MVF, Franco RMB. High prevalence of Blastocystis spp. infection in children and staff members attending public urban schools in Sao Paulo state, Brazil. Revista do Instituto de Medicina Tropical de São Paulo. 2016; 58.
34. Archer J, O'Halloran L, Al-Shehri H, Summers S, Bhattacharyya T, Kabaterine NB, et al. Intestinal schistosomiasis and giardiasis co-infection in sub-

Saharan Africa: Can a One Health approach improve control of each waterborne parasite simultaneously? Tropical medicine and infectious disease. 2020; 5(3): 137.
35. Hossain B, Rashid H, Noor Z, Kabir M, Miah S, Siddique A, et al. A systematic review of human giardiasis in Bangladesh: public health perspective. Research Square. 2020; 1-18.
36. da Fonseca REP, Barbosa MCR, Ferreira BR. High prevalence of enteroparasites in children from Ribeirão Preto, São Paulo, Brazil. Revista brasileira de enfermagem. 2017; 70(3): 566–71.
37. Lopes IL, Zani T, Borges FV. Prevalência de parasitoses intestinais em crianças de uma escola pública em Cariacica–ES. Sapientia. 2013; 50-53.
38. Dias MGPF, Fregonesi BM, Zagui GS, de Abreu Tonani KA, Julião FC, Beda CF, et al. Enteroparasitos em crianças de instituição de ensino filantrópica: ênfase para Cryptosporidium spp. e Giardia spp. Arquivos de Ciências da Saúde. 2018; 25(1): 51–5.
39. Shrivastava AK, Kumar S, Smith WA, Sahu PS. Revisiting the global problem of cryptosporidiosis and recommendations. Tropical parasitology. 2017; 7(1): 8.
40. Berne AC, Scaini CJ, Villela MM, Pepe MS, Haupenthal LE, Gatti F, et al. Presença de coccídios e outros enteroparasitos em uma população de crianças no município de Rio Grande, Rio Grande do Sul, Brasil. Revista de Patologia Tropical/Journal of Tropical Pathology. 2012;41(1).
41. Pedraza DF, Queiroz D de, Sales MC. Infectious diseases among Brazilian preschool children attending daycare centers. Ciencia & Saude Coletiva. 2014; 19(2): 511–28.
42. de Vargas ÉG, Amaral CP. Estudo da importância da intervenção pedagógica na prevenção de doenças parasitológicas. Multiciência Online. 2016; 74-97.
43. Reuter CP, da Silva Furtado LBF, da Silva R, Pasa L, Klinger EI, dos Santos CE, et al. Frequência de parasitoses intestinais: um estudo com crianças de uma creche de Santa Cruz do Sul-RS. Cinergis. 2015; 16(2).
44. de Almeida Cardoso L, Cavalcante CS, Morais KF, dos Santos Medeiros J. Parasitoses intestinais em crianças que frequentam creches. Journal of Biology & Pharmacy and Agricultural Management. 2018; 15(1).
45. Arruda AA, de Quadros RM, de Lima Miguel R, Miletti LC, Ramos CJR. Detecção de oocistos de Cryptosporidium spp. em crianças atendidas no Laboratório do Hospital Infantil da cidade de Lages, SC. Revista Brasileira de Higiene e Sanidade Animal. 2020;14(4): 1–12.
46. Silva ET da, Rocha AB, Silva FA da. Educação em saúde na escola : promovendo a saúde por meio do lúdico, da linguagem artística e da literatura infantil. Journal of Management & Primary Health Care. 2016; 7(1): 2016.
47. Lubini VT, Willrich JQ, Emanuel G, Pinheiro W, Prado L, Pickersgill MF. Impacts of Educational Action on Health Indicators: Potentiality and Fragilities. Revista de Enfermagem UFPE online. 2018; 12(6).
48. Fernanda M, Figueiredo S, Felício J, Neto R, Reis TC. Modelos Educacionais Não Críticos e Críticos aplicados à Educação em Saúde Educational Models Not Critical and Critical applied to Health Education. Revista Norte Mineira De Enfermagem. 2012; 1(1): 79–90.
49. Matos S, Franco A. A Educação Integral. Pesquisa e Ação. 2016; 2(1): 57–65.

Tabela 1: Relative and absolute frequency of enteroparasitosis identified in children under 12 years old, from 2008 to 2018, in the ity of Recife-PE.

Intestinal	2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		Mean
parasites	N=24	%	N=11	%	N=16	%	N=27	%	N=48	%	N=22	%	N=10	%	N=37	%	N=68	%	N=16	%	N=30	%	%
Giardia lamblia	5	20.8	5	45.5	5	31.3	6	22.2	11	22.9	5	22.7	2	20	5	13.5	0	0	9	54.8	11	36.6	26.4
Endolimax nana	7	29.1	2	18.2	4	25	5	18.5	12	25	6	27.3	4	40	9	24.3	11	15.3	2	12.5	11	36.6	24.7
Cryptosporidium spp	0	0	0	0	0	0	8	29.6	6	12.5	3	13.6	0	0	28	75.7	39	56.7	1	4	0	0	17.5
Entamoeba coli	1	4	1	9.1	3	18.8	3	11.1	6	12.5	3	13.6	1	10	1	2.7	0	0	2	14.2	4	13.3	9.9
E. hystolitica/E. dispar	3	13	1	9.1	1	6.25	1	3.7	9	18.8	2	9.09	0	0	3	8	0	0	2	14.2	0	0	7.4
Ascaris lumbricoides	5	20.8	1	9.1	0	0	2	7.4	2	4.16	0	0	2	20	3	8	10	14.3	0	0	2	6.66	8.2
Blastocystis hominis	0	0	0	0	2	12.5	1	3.7	0	0	0	0	0	0	0	0	0	0	0	0	1	3.33	1.7
Ancilostoma sp.	0	0	1	9.1	0	0	1	3.7	0	0	0	0	0	0	0	0	7	10.2	0	0	0	0	2.1
Iodameba butschlii	0	0	0	0	1	6.25	0	0	0	0	1	4.54	0	0	0	0	0	0	0	0	0	0	0.9
Balantidium coli	3	13	0	0	0	0	0	0	0	0	2	9.09	0	0	0	0	0	0	0	0	0	0	2
Trichuris trichiura	0	0	0	0	0	0	0	0	2	4.16	0	0	1	1	0	0	0	0	0	0	0	0	0.5
Taenia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3.33	0.3